

9 guide means; and

10 an optical film of transparent material positioned between
11 said back surface of said liquid crystal display panel and said
12 top surface of said light guide means, including a first surface
13 having a wave structure including a plurality of regularly spaced
14 isosceles triangle prisms arranged side-by-side, the prisms
15 having smooth surfaces, and a second surface having an optically
16 rough structure for performing diffuse transmission, wherein a
17 top angle of said isosceles triangle prisms is in a range of 95
18 degrees to 120 degrees for flat, angled prism surfaces to gather
19 light from the diffuse transmission into a desired viewing angle
20 for the liquid crystal display panel.

21 Claim 7 (Amended)

1 A liquid crystal display device according to claim 5,
2 wherein a polarizer is positioned between said liquid crystal
3 display panel and said optical film, and a direction along which
4 said peaks and valleys of said isosceles triangle prisms are
5 oriented is aligned in parallel to a polarizing axis of said
6 polarizer and the tops of the isosceles triangle prisms are not
7 farther than 160 μ m apart.

Claim 8 (Twice Amended)

1 A liquid crystal display device including a liquid crystal
2 display panel and a back light device, said back light device
3 comprising:

4 a light source for emitting light;

5 a light guide means having a top surface facing a back
6 surface of said liquid crystal display panel and a side surface
7 receiving said light from said light source;

8 a reflector means provided on a back surface of said light
9 guide means; and

10 two optical films of transparent material positioned between
11 said back surface of said liquid crystal display and said top
12 surface of said light guide means, each of said optical films

13 including a first surface having a wave structure including a
14 plurality of isosceles triangle prisms arranged side-by-side, the
15 prism having smooth surfaces, and a second surface having an
16 optically rough structure for performing diffuse transmission
17 wherein a top angle of said isosceles triangle prisms is in a
18 range of 95 degrees to 120 degrees for flat, angled prism
19 surfaces to gather light from the diffuse transmission by the
20 second surface into a desired viewing angle for the liquid
21 crystal display panel.

22 Claim 11 (Amended)

23 A liquid crystal display device according to claim 8,
24 wherein a polarizer is positioned between said liquid crystal
25 display panel and said two optical films, and a direction along
26 which peaks and valleys of said isosceles triangle prisms of said
27 optical film closer to said polarizer is oriented in parallel to
28 a polarizing axis of said polarizer and the tops of the isosceles
29 triangle prisms are no more than 160 um apart.

Claim 12 (Twice Amended)

1 A liquid crystal display device including a liquid crystal
2 display panel and a back light device, said back light device
3 comprising:

4 a light source for emitting light;

5 a light guide means having a top surface facing a back
6 surface of said liquid crystal display panel and a side surface
7 receiving said light from said light source;

8 a reflector means provided on a back surface of said light
9 guide means; and

10 an optical film of transparent material positioned between
11 said liquid crystal display panel and said light guide means,
12 including a first surface having a structure including a
13 plurality of quadrangular prisms, which are substantially the
14 same size and shape, in an orderly matrix of equally spaced
15 prisms, the prisms having smooth surfaces, and a second surface

16 having an optically rough structure for performing diffuse
17 transmission wherein a top angle of said quadrangular prisms is
18 in a range of 95 degrees to 120 degrees for flat, angled sides of
19 the prisms to gather the light from the diffuse transmission of
20 the second surface into the desired viewing angle for the liquid
21 crystal display device.

22 Claim 14 (Amended)

23 A liquid crystal display device according to claim 12,
24 wherein a polarizer is positioned between said liquid crystal
25 display panel and said optical film, and a direction along which
26 peaks and valleys of said quadrangular prisms of said optical
27 film are oriented in parallel to a polarizing axis of said
28 polarizer and the tops of the quadrangle prisms are no more than
29 160 μ m apart.

REMARKS

The present invention provides a low distortion, high-luminance back light device for directing light through a liquid crystal display (LCD) panel. As shown in Fig. 1, the LCD panel 1 includes liquid crystal material retained between glass sheets 2 and 3 with two polarizers 4 and 5 with orthogonally oriented polarizing axes on either side. The back light device 6 for display includes fluorescent lamps 7, a light guide 8, an optical film 8 and a patterned reflector 12.

In accordance with the present invention, the optical film 8 is configured to provide a maximum of uniform, low-distortion illumination within the "viewing angle" for LCD devices which "viewing angle" is defined as at least $\pm 35^\circ$ in the vertical direction and $\pm 55^\circ$ in the horizontal direction. The film has an optically rough bottom face to first diffuse the light and a second smooth angled top face to concentrate the diffused light into the conical space defined by the vertical and horizontal